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RAINFALL TYPES

OF THE

UNITED STATES

ANNUAL REPORT BY VICE-PRESIDENT

GENERAL A. W. GREELY

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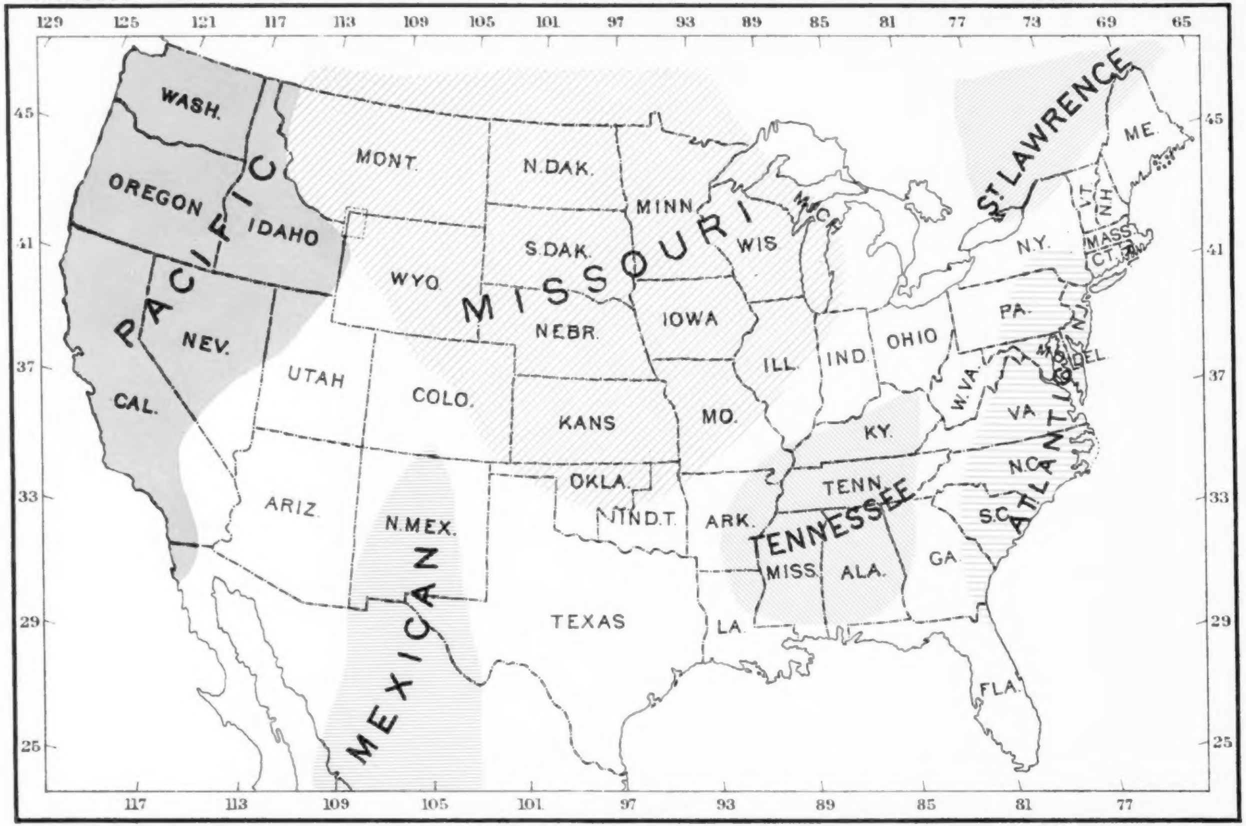

SIMPLE TYPES OF RAIN FALL DISTRIBUTION

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(Presented before the Society January 6, 1893)

In carrying out the announced policy of the National Geographic Society with regard to annual contributions from its vice-presidents in their respective domains of geographic science, it has seemed advisable for the vice-president of the "Geography of the Air" to place before the Society this year a special paper.

The subject selected is the typical distribution of rainfall in the United States and contiguous territory, and an attempt has been made to treat the subject in such a manner that it may be a permanent contribution to the physical geography of the United States. It goes without saying that a paper covering twenty minutes' reading cannot go much into detail, but it is hoped that the treatment, while general, is yet such as to give definite and clear ideas on the subject treated.

This paper does not consider the distribution of rain from the standpoint of the mean annual precipitation, does not dwell on the variability or unequal amounts in consecutive years, omits to discuss the distribution from the standpoint of varying elevations, and is silent on the question of distribution with reference to frequency or absence of excessive rains of periodic or acci-

dental occurrence. It confines itself to a question of great and sometimes vital importance, to the characteristic distribution of precipitation throughout the year, and, as is believed, presents a successful analysis of the average fluctuations from month to month, so that for the first time a satisfactory presentation is possible of all the simple rainfall types and of most of the composite types which obtain over the broad expanse of the inhabited portions of North America.

The necessity of careful and scientific study of climatic conditions in connection with prospective enterprises, whether pertaining to agriculture, commerce, navigation, or to special industries, has become obvious the past few years through the spur of competition. Among such conditions, this of rainfall distribution throughout the year is one of the most important. With relation to agriculture, it is essential to know whether precipitation comes at such seasons as to be a benefit or a detriment to the proposed crop. In the initiation of irrigation enterprises not only are the questions of guarding against extensive and torrential rainfalls on one hand and of tiding over temporary droughts on the other of importance, but, further, whether the most copious precipitation occurs in such months as to afford water at seasonable periods, or the rain comes at such times that it must be stored for many months with consequent loss from seepage and evaporation. Similarly, this question of distribution of rain throughout the year affects most potently other business interests of importance.

That these questions are of current and practical value is evident to every thoughtful man, and that their earlier elucidation and the publication of results would have been an extended benefit cannot be questioned. Take agriculture, for instance, which in eastern Colorado is pursued under difficult conditions wherever irrigation is impracticable. Failure of crops very frequently resulted until observation showed that a scanty rainfall in June is the rule in that section, and that by planting at a certain season the injurious effects of the June drought could be mitigated.

Nor is the necessity of a definite and accurate determination of the typical forms of annual precipitation in the eastern part of the United States less obvious, since the latest text-book on meteorology in use in the United States, that of Loomis, contains the statement that " Throughout most of the United States east

of the Rocky mountains the rain is pretty equally distributed through the different months of the year, but the rain of summer is *everywhere* somewhat greater than that of winter, including melted snow."

In reality the whole section of country, about 200,000 square miles in extent, dominated by the Tennessee type of rainfall experiences a larger precipitation in winter than in summer, the excess averaging in northern Alabama and southern Kentucky about 10 per cent, in western Georgia and in Tennessee over 20 per cent, and in southeastern Arkansas and northern Louisiana from 40 to 50 per cent (plate 20).

I have pointed out elsewhere the vital importance of a favorable distribution of rainfall to certain sections of the country, where this favoring type of precipitation has proved to be one of the great bases on which rests the national prosperity of this great republic. Allusion is made to the great grain-producing sections throughout the water-sheds of the upper Mississippi, the Missouri, the Red river of the North, comprising the Dakotas, Minnesota, Kansas, Nebraska, Iowa, Missouri, Wisconsin and Illinois. Over the greater part of this immense area the annual rainfall is very materially less than that of the regions to the eastward or southward, but, most fortunately for the country, about three-fifths of the rainfall for the entire year occurs opportunely through the period when it is most beneficial to crops, from April to July, inclusive. A less favorable type of rainfall, the Mexican or the Saint Lawrence, for example, would render growing of grain unprofitable throughout the whole of this favored region.

It remains to briefly indicate the few types of simple rainfall with the localities to which they refer, and to the composite types occurring through the overlapping and interference of simple types.

Composite types must prevail where two simple types are not separated by high mountain ranges, and thus gradually shade or merge into each other. One dividing line, the Rocky mountain range, separates by its crest, if not absolutely, yet quite sharply and definitely, the Missouri type in Montana and Wyoming from the Pacific type in Idaho and Washington.

The term *simple* has been applied to those rainfall types which can be graphically expressed by a curve with a single bend or inflection. The average monthly amounts pass from the single

maximum to the single minimum through uninterruptedly diminishing quantities, and thence rise with unbroken increases to the maximum. The *composite* types are those in which the graphic expression would be shown by two inflections, from a primary maximum through the minimum to a secondary maximum and secondary minimum.

In general terms it may be said that each simple type of rainfall in the United States appertains to a single body of water for its resulting precipitation; thus the Pacific type comes directly from the Pacific ocean, the Mexican type from the gulf of California, the Tennessee type from the gulf of Mexico, and the Atlantic type from the Atlantic ocean. In the Missouri type, however, two sources are evident—primarily the gulf of Mexico, and secondarily, and to a much larger degree than has been usually advanced, Hudson bay and the chain of great American lakes.

In treating the fluctuations of rainfall throughout the year it is evident that the unequal lengths of the different months affect somewhat the accuracy of direct inter-comparisons of normal monthly rainfalls. There fell under my observation lately a curve showing such inter-comparisons which proved misleading, as it showed a decrease of rain from January to February and an increase from February to March, when in reality, as shown by the average amount daily for each month, the rainfall became more copious from January to February and from February to March.

In this discussion the rule has been followed of obtaining the normal daily rainfall by dividing the normal yearly rainfall by 365.25. In like manner the average daily rainfall of February has been found by using 28.25 as a divisor, and the longest months by using 31. In this paper, for the sake of brevity and in order to avoid repetition, it is to be explained that the term "normal daily rainfall" is applied to the mean determined from the annual precipitation, and that the terms "January rainfall, March rainfall," etc, unless otherwise explicitly stated, mean the average daily amount determined for the month in question by the methods above indicated.

The best defined type of rainfall within the limits of the United States is that which dominates the Pacific coast region; hence the specific name "Pacific" herein applied. In general terms it may be said to dominate British Columbia, Washington,

Idaho, Oregon, California, Nevada and western Utah; in other words, the great interior basin and the entire Pacific water-shed from British Columbia to Lower California, excluding the section draining into the gulf of California. The characteristic features are very heavy precipitation during midwinter, and an almost total absence of rain during the late summer.

The infrequency of summer rain is marked in British Columbia, and thence southward it becomes steadily more pronounced, passing through the gradations of a single rainless month in northern California, then two and three to its culmination of four rainless months in a considerable part of southern California and western Nevada. There is a tendency in the upper half of the San Joaquin valley and thence southward into the western part of San Diego county for rain to cease about a month earlier and to remain absent a month later than over the rest of the Pacific coast region, the dry season being from June to September, inclusive, and being usually unbroken even by a passing shower.

Eastern Nevada appears to share freedom from rain during July, but the autumnal rains appear in September or earlier, under the influence in the southern part of that state of the Mexican type projecting northward. The marked tendency of the winter rains to continue into spring is evident in Washington, whence it shades with diminishing persistency to northern California and northwestern Nevada.

It may be remarked that in the Pacific coast regions the amounts of rain vary very greatly, according to the topography of the section and the distance from the ocean; so that the interior depressions, such as the Sacramento, San Joaquin and other valleys, particularly those parallel with the coast, have a scantier rainfall than either the coast itself or the Sierra Nevada and other mountain ranges to the eastward.

These variations in the total rainfall do not, however, affect the distribution throughout the year, which is typically Pacific throughout the whole region.

As might be expected where the rainfall is very small, a single month of excessive precipitation occasionally increases the rainfall so as to be misleading. For instance, it is apparent from inspection that the greatest normal precipitation is that of December at both San Diego, California, and Halleck, Nevada; yet excessive rainfalls of 9.05 inches in February, 1884, at the former

place, and 4.00 inches in February, 1870, at the latter, throw the February daily precipitation slightly above that of December. Of the following examples of the Pacific type, five are drawn from the interior, viz, Spokane, Washington, records of 12 years; Delano, California, 15 years; Boisé City, Idaho, 22 years; Promontory, Utah, 21 years; Halleck, Nevada, 21 years; and three from coast stations, viz, Astoria, Oregon, 29 years; San Diego and San Francisco, California, each 41 years.

Normal daily Rainfall and monthly Departures therefrom.

(*Values are in fractions of an inch.*)

STATIONS.

	Astoria, Oregon (normal daily rainfall for 29 years, .207).	San Francisco, Cal. (normal daily rainfall for 41 years, .066).	San Diego, Cal. (normal daily rainfall for 41 years, .027).	Delano, Cal. (normal daily rainfall for 15 years, .017).	Spokane, Wash'n (normal daily rainfall for 12 years, .055).	Boisé City, Idaho (normal daily rainfall for 22 years, .040).	Halleck, Nev. (normal daily rainfall for 21 years, .020).	Promontory, Utah (normal daily rainfall for 21 years, .021).
DEPARTURES.								
January	.208	.099	.027	.010	.034	.040	.012	.015
February	.094	.060	.044	.029	.055	.014	.020	.008
March	.109	.039	.015	.013	— .010	.019	.002	.004
April	— .035	— .002	— .003	.015	— .015	.016	.001	.005
May	— .092	— .064	— .016	.000	— .013	.005	.010	.000
June	— .114	— .066	— .027	— .017	.009	— .014	— .008	— .008
July	— .169	— .066	— .027	— .017	— .032	— .033	— .018	— .014
August	— .166	— .066	— .027	— .017	— .042	— .034	— .016	— .009
September	— .099	— .061	— .027	— .017	— .020	— .028	— .016	— .002
October	— .050	— .034	— .016	— .007	.006	— .013	— .001	— .002
November	.131	— .030	— .008	.009	— .006	.003	— .001	— .003
December	.187	.106	— .042	.011	.033	.028	.013	.009

Another simple type of rainfall is that which in a previous paper I designated as the "Trans-Pecos," from the fact that it dominates extreme western Texas beyond the Pecos river. On further investigation it proved to prevail in the province of

Chihuahua, and now later data shows the great probability that it dominates far the greater part of Mexico; hence it is now called the "Mexican" type.

The characteristics of the Mexican type are very heavy precipitation after the summer solstice and a very dry period after the vernal equinox. August is the month of greatest rainfall and, with July and September, furnishes over 75 per cent of the year's precipitation at Mazatlan, about 87 per cent at Topolobampo, 58 per cent at El Paso, Texas, fort Davis, Texas, and fort Union, New Mexico. On the other hand, the months of February, March and April are marked by an almost entire absence of precipitation, aggregating for this period only 1 to 2 per cent of the year's rain on the western coast of Mexico, and about 8 per cent at Chihuahua, Mexico, the city of Mexico, El Paso, Texas, fort Davis, Texas, and fort Union, New Mexico (34 years).

This type dominates New Mexico, save the small drainage basins of the Gila and San Juan, the trans-Pecos region of Texas, and probably all of Mexico, except the eastern coast and possibly the southern part of that country. The proof of its prevalence in Mexico rests on about ten years' observations at the city of Mexico, ten at Pueblo (where, however, the type is composite and the maximum falls in July, conforming to the rainfall regime of Vera Cruz as given by Loomis), six years at Mazatlan, seven at Leon de Aldemas, five at Chihuahua and four at Topolobampo.

While the Mexican type of rainfall does not absolutely obtain in Arizona, yet, taken as a whole, its influence is more potent than that of the Pacific type. The Arizona rainfall is of a composite type, the result of interference between the Pacific and Mexican. The primary maximum, closely following the Mexican type, occurs from July to August, while most generally the second maximum falls with the Pacific type in December. Interference of the types, however, brings about the principal minimum in October and the secondary minimum in May or June.

The following shows the departures from the daily normal rainfall of .028 inch at fort McDowell, deduced from the longest record (24 years) in Arizona: January, .006 inch; February, .015; March, —.004; April, —.010; May, —.024; June, —.024; July, —.012; August, .019; September, .003; October, —.014;

November, —.001, and December, .028. Similarly Colorado and a portion of Texas to the eastward of the Pecos water-shed experience a composite type of rainfall arising from interference of the Mexican type from the westward and the Missouri type from the eastward.

Colorado has its principal rainfall maximum in July or August and its principal minimum in January, while the secondary maximum occurs in April or May and a secondary minimum in June. It is hardly necessary to state that certain localities, according to their contiguity either to the simple Mexican or the simple Missouri type in their rainfall, reverse in order of importance the primary and secondary maxima and minima here mentioned.

Utah has a great diversity of rainfall fluctuations, resulting from its being so situated that it is more or less influenced from different quarters by the Pacific, Mexican, and even the Missouri type, the first named being most potent, especially in the western and extreme northern part of the territory.

The "Missouri" type of rainfall is the most important in the United States, both from the vast area over which it obtains and also from its extremely favorable bearing on agriculture. This type dominates the water-sheds of the Arkansas, Missouri, and upper Mississippi rivers and of lakes Ontario and Michigan, as well as over Oklahoma and the greater part of northern Texas, thus covering Montana, the Dakotas, Minnesota, Nebraska, Kansas, Iowa, Missouri, Oklahoma, Wisconsin and Illinois, together with parts of Arkansas, Texas, Michigan, Indiana and Indian territory.

The Missouri type indicates a very light winter precipitation, followed in late spring and early summer by the major quantity of the yearly rain. The area of country covered by this type is so large that certain slight modifications could be anticipated. For instance, while the June rainfall is as a rule the most abundant, yet along the eastern slope of the Rocky mountains the May rainfall is somewhat greater than that of the following month. Again, while January is usually the month of least precipitation, yet in some localities the minimum has a tendency to occur in December and in others to delay itself until February.

As examples of the Missouri type, there are here presented rainfall data from Riley, Illinois, record of 39 years; Muscatine,

Iowa, 45; Bismarck, North Dakota, 18; Fort Randall, South Dakota, 32; Fort Ripley, Minnesota, 27; Fort Riley, Kansas, 36; Miami, Missouri, 43; Fort Shaw, Montana, 19; Omaha, Nebraska, 24, and Madison, Wisconsin, 24 years:

Normal daily Rainfall and Departures therefrom.

(Values are in fractions of an inch.)

STATIONS.

	Fort Shaw, Mont. (normal daily rainfall for 19 years, .028).	Bismarck, N. Dak. (normal daily rainfall for 18 years, .052).	Fort Randall, S. Dak. (normal daily rainfall for 32 years, .056).	Fort Ripley, Minn. (normal daily rainfall for 27 years, .074).	Madison, Wis. (normal daily rainfall for 24 years, .097).	Omaha, Neb. (normal daily rainfall for 24 years, .091).	Fort Riley, Kans. (normal daily rainfall for 36 years, .069).	Muscatine, Iowa (normal daily rainfall for 45 years, .107).	Miami, Mo. (normal daily rainfall for 43 years, .096).	Riley, Ill. (normal daily rainfall for 39 years, .108).
	DEPARTURES.									
Jan.....	— .016	— .037	— .043	— .047	— .036	— .069	— .049	— .045	— .044	— .023
Feb.....	— .014	— .029	— .036	— .041	— .036	— .065	— .038	— .033	— .035	— .034
Mar....	— .013	— .018	— .023	— .024	— .011	— .044	— .041	— .020	— .021	— .023
April...	— .005	.022	.002	— .020	.049	.013	— .004	.005	.001	— .011
May ...	.037	.032	.058	.023	.019	.054	.036	.035	.034	.014
June...	.037	.068	.053	.071	.043	.097	.060	.052	.074	.030
July ...	.007	.026	.031	.057	.042	.075	.053	.020	.037	.016
Aug....	.002	.019	.027	.032	.009	.019	.045	.035	.021	.022
Sept....	.000	— .013	.011	.036	.013	.021	.029	.020	.020	.015
Oct.....	— .011	— .014	— .014	— .022	— .005	— .002	— .014	— .009	.002	— .022
Nov....	— .013	— .032	— .040	— .017	— .030	— .050	— .026	— .022	— .027	— .031
Dec.....	— .011	— .028	— .029	— .045	— .033	— .058	— .045	— .031	— .033	— .042

The general character of the Missouri type is, perhaps, satisfactorily illustrated by the rainfall of Nebraska, this state being central, as regarding this type. In Nebraska only about 6 per cent of the year's precipitation occurs from December to February, inclusive. In April, however, the percentage of the entire annual rainfall is 11, in May 17, in June 16 and July 16, making about 60 per cent for these four months. In other words, three-fifths of the yearly rainfall occurs most opportunely during the period when it is most beneficial to the growing crops. It is well known that the annual rainfall is small, yet

eastern Nebraska receives during these four months, April to July, inclusive, a larger amount of rainfall than the interior portions of the eastern states from Maine to Virginia; and western Nebraska receives only a slightly lesser amount. While the rain precipitation of the year diminishes to the northward and westward of Nebraska, yet the same favorable type of distribution prevails.

The Missouri type changes by interference with the Mexican type in the southwest, the Tennessee type to the southeast, and the Saint Lawrence to the northeast.

The "Tennessee" type, although not covering a very extended region, is well marked, the highest rainfalls occurring the last of winter or the first of spring, while the minimum is in mid-autumn.

The Tennessee type obtains over Tennessee, Arkansas, Mississippi, eastern Kentucky, western Georgia and, except on the immediate gulf coast, in Alabama and Louisiana. In some localities (western Kentucky and Tennessee and adjacent parts of Arkansas) the rain of February slightly exceeds that of March, the usual month of maximum, while in northern Louisiana and adjacent regions, the tendency is toward slightly greater rainfalls in April than in March.

It is also to be noted that in some cases there is a tendency toward the minimum rainfall in August or September rather than October, in which month the minimum occurs for the greater portion of the area.

Montgomery, Alabama; Atlanta, Georgia; Chattanooga and Memphis, Tennessee, are examples of the Tennessee type of precipitation.

Normal daily Rainfall and Departures therefrom.

(Values are in fractions of an inch.)

STATIONS.

	Atlanta, Ga. (normal daily rainfall for 26 years, .143).	Knoxville, Tenn. (normal daily rainfall for 20 years, .146).	Memphis, Tenn. (normal daily rainfall for 20 years, .148).	Montgomery, Ala. (normal daily rainfall for 20 years, .147).
DEPARTURES.				
January	.022	.040	.041	.014
February	.042	.043	.052	.049
March	.044	.037	.037	.049
April	.007	.023	.037	.031
May	— .021	— .023	— .011	— .010
June	— .002	— .003	.019	.014
July	— .020	— .007	— .046	— .010
August	.002	— .007	— .025	— .024
September	— .010	— .042	— .035	— .041
October	— .060	— .044	— .047	— .062
November	— .013	— .009	.012	— .026
December	.015	— .012	.025	.015

Except in New England the entire water-shed of the Atlantic coast experiences a type of rainfall distribution which extends to the drainage basin of the upper Ohio river. This type is called the "Atlantic," and is one wherein the distribution throughout the year is nearly uniform. The rainfall of Philadelphia, record of 73 years, shows that the minimum daily rainfall of October and January is 73 per cent of the maximum daily fall in August. The most copious precipitation occurs after the summer solstice, while the minimum rainfall is, as a rule, during

the mid or late autumn, the increases until early spring being very small and irregular. Generally, it may be said that a well marked tendency obtains along the coast toward August as the month of maximum rainfall. With increasing distance from the Atlantic ocean, and probably owing to influence of the trans-Appalachian types, the time of greatest precipitation generally shifts to July, while the minimum rainfall, which occurs during November from Florida to western New York, gradually changes to October along the slope of the Appalachian range and the upper Ohio valley, as shown in both phases by the records of Augusta, Georgia, and Pittsburg, Pennsylvania.

The effect of interference of the Saint Lawrence type extending southward is evident at Troy, New York, in its minimum of February and March, and even as far as Philadelphia it exercises a very slight influence.

Normal daily Rainfall and Departures therefrom.

(Values are in fractions of an inch.)

STATIONS.

	Charleston, S. C. (normal daily rainfall for 62 years, .133).	Fort Monroe, Va. (normal daily rainfall for 55 years, .117).	Philadelphia, Pa. (normal daily rainfall for 63 years, .117).	Newark, N. J. (normal daily rainfall for 44 years, .126).	Augusta, Ga. (normal daily rainfall for 22 years, .130).	Pittsburg, Pa. (normal daily rainfall for 22 years, .103).	Troy, N. Y. (normal daily rainfall for 60 years, .099).	New York city (normal daily rainfall for 53 years, .126).
	DEPARTURES.							
January	— .038	— .018	— .012	— .008	.014	.000	— .020	— .010
February	— .030	— .011	— .009	.001	.010	— .001	— .023	— .002
March	— .019	— .002	— .007	— .004	— .003	— .010	— .022	— .006
April	— .050	— .013	— .001	— .008	— .005	— .012	— .007	— .008
May	— .014	.001	.004	.002	— .019	.006	.003	.007
June	.020	.006	.015	— .007	.011	.019	.030	.006
July	.075	.032	.013	.012	.035	.054	.032	.003
August	.097	.037	.026	.038	.024	.007	.011	.025
September	.050	.005	.000	— .001	.003	— .015	.004	— .004
October	— .026	— .020	— .012	— .011	— .044	— .019	.012	— .011
November	— .052	— .018	— .006	— .005	— .018	— .016	— .001	.000
December	— .031	— .005	— .006	— .003	— .012	— .014	— .017	— .003

In New England the Atlantic type is seriously modified and the character of the distribution, difficult to determine with exactness owing to the slight variations, is possibly affected by the interference of the Saint Lawrence type. In consequence, we find in New England a composite type in which the August maximum of the Atlantic type is generally primary, and a November maximum secondary, though in some localities these maxima are reversed in order of their importance. The Atlantic November minimum is replaced by a June primary minimum, while a secondary minimum falls in some localities in September and in others in April.

Normal daily Rainfall and Departures therefrom.

(*Values are in fractions of an inch.*)

STATIONS.

	Waltham, Mass. (normal daily rainfall for 64 years, .115).	Amherst, Mass. (normal daily rainfall for 52 years, .122).	Lowell, Mass. (normal daily rainfall for 62 years, .125).	New Bedford, Mass. (normal daily rainfall for 75 years, .127).	Hanover, N. H. (normal daily rainfall for 50 years, .100)	Lunenburg, Vt. (normal daily rainfall for 40 years, .110).	Gardiner, Me. (normal daily rainfall for 50 years, .121).	Boston, Mass. (normal daily rainfall for 74 years, .129).
DEPARTURES.								
January	— .016	— .014	— .017	— .001	— .006	— .013	— .009	— .001
February	— .019	— .009	— .013	.008	— .017	— .008	.007	.005
March	— .003	— .011	— .003	.008	— .024	— .005	.006	.012
April	.010	— .016	.005	.005	— .021	— .021	— .008	.006
May	.000	.003	.004	.000	.006	.005	.001	— .007
June	— .010	.003	— .003	— .022	.015	.022	— .014	— .020
July	.005	.022	.001	— .019	.012	.018	— .013	— .009
August	.031	.021	.028	— .011	.018	.009	.000	.013
September	— .004	— .007	— .007	— .011	.000	.001	— .012	— .011
October	.003	.003	.003	.000	.010	.004	.023	— .005
November	.021	.006	.016	.017	.027	— .003	.022	.015
December	— .018	— .006	— .010	.006	— .019	— .015	.001	— .001

The distribution of rain through the Saint Lawrence valley, although of composite type, probably merits from its peculiarity to be designated separately as the "Saint Lawrence" type. The

characteristics are scarcity of precipitation during the spring months, April being very decidedly the month of least rainfall followed by October, and a heavy rainfall during the late summer and late autumn months with the maximum precipitation in November and nearly as heavy rain in July or August. The heavy rainfalls of the Saint Lawrence valley during November are the more remarkable in view of the fact that in this month the minimum precipitation occurs from northern Florida to central New York.

Detailed data regarding this type is not at hand, but Professor Charles Carpmael, chief of the meteorological service of the Dominion of Canada, is authority for the statement that the minimum precipitation occurs in April at Kingston, Rockliffe, Montreal, Quebec, Father point, Saugeen, and Parry sound, as well as throughout the province of New Brunswick. It is interesting to note that in the composite rainfall types of Newfoundland and New Brunswick, as well as along the greater part of the Massachusetts and Maine coasts, the November maximum obtains, and is as a rule the principal maximum, with March as the month of secondary maximum, although in some localities these maxima are reversed in order of importance.

There may possibly be added a Gulf type, so called from its prevalence along the northern shores of the gulf of Mexico, where the maximum rain falls in September and the minimum in the early spring. Western Florida and the Texas coasts are the only sections in which this obtains. The normal daily rainfall at Key West, Florida, of 47 years, is .107 inch, with departures as follows: January, — .038; February, — .050; March, — .062; April, — .064; May, — .006; June, .044; July, .022; August, .055; September, .111; October, .053; November, — .038, and December, — .043 inch.

It is not within the scope of this paper to discuss the special causes which produce these differing types of rainfall distribution in North America. It may be said, however, that there is no doubt in my mind that the maxima and minima phases of precipitation are simply the result of the fluctuation throughout the year of atmospheric pressure over North America and its contiguous waters, thus affecting the relative positions of high and low areas and consequently causing winds, either favorable or unfavorable to precipitation, according to season and locality.